REMARKS

Claims 1-18 are pending in this application. Claims 2, 8, 16 and 18 are canceled without prejudice or disclaimer, claims 1, 15 and 17 are amended herein. Upon entry of this amendment, claims 1, 3-7, 9-15 and 17 will be pending. Entry of this amendment and reconsideration of the rejections are respectfully requested.

No new matter has been introduced by this Amendment. Support for the amendments to claims 1, 15 and 17 may be found, for example, in original claims 2, 16 and 18.

General comments regarding the present invention

The present invention relates to a resin composition for GHz-band electronic components, wherein the nanoscale carbon tubes are present in a very small amount in the resin, thereby reducing $\tan\delta$.

Generally speaking, when an electric conductive material is mixed in a resin, $\tan\delta$ increases. The reason is explained with reference to Fig. A below.

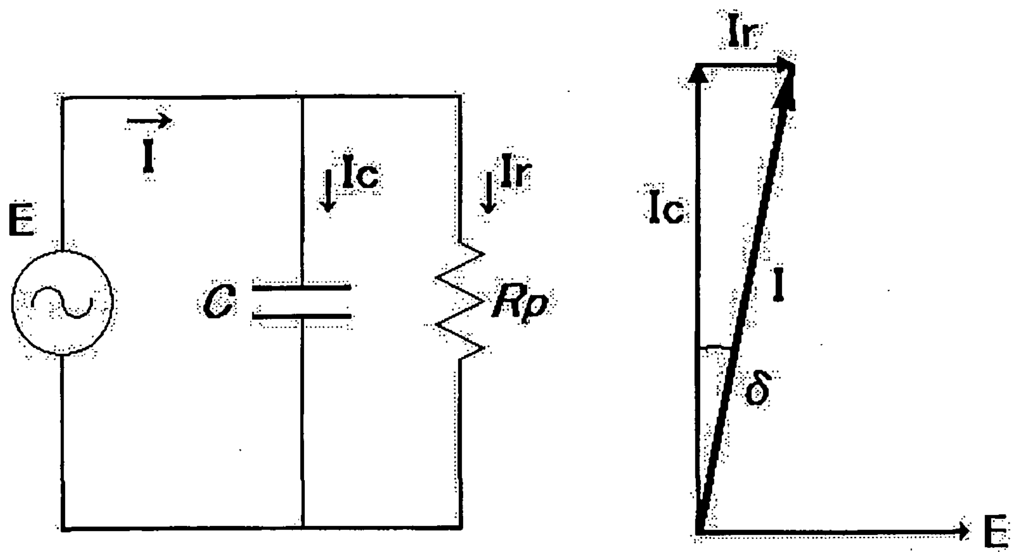

Figure A

In a capacitor, resistance is generated by the thermal oscillation of the constituent molecules of the dielectric. As a result, an electric charge transfer causes energy loss. The loss becomes significant when a high-frequency alternating current is applied.

As shown in Fig. A above, in an actual capacitor diagramed in an equivalent circuit, the ideal capacitor (a resistance-free capacitor) C is parallel to the parasitic resistance Rp.

When the electricity running in the ideal capacitor is expressed as Ic, and the electricity running in the parasitic resistance (equivalent to energy loss) is Ir, the following formula is defined.

$Ir/Ic=1/(\omega CRp)=\tan\delta$

In other words, when parallel resistance Rp is reduced by the addition of an electric conductive material such as a nanoscale carbon tube, an increase of tanδ is expected.

As described above, when nanoscale carbon tubes are admixed, tanδ is expected to increase. Despite this, the present invention can unexpectedly reduce tanδ by mixing the nanoscale carbon tubes. This is an unexpected result of the present invention, discussed below in regard to the claim rejections.

Claims 1, 2, 4, 5, 7, 8, and 12-18 are rejected under 35 U.S.C. §102(b) as being anticipated by Glatkowski et al. (US 2003/0008123 A1). (Office action paragraph no. 2)

The Examiner cites Glatkowski as disclosing a dielectric comprising a polymer matrix and a plurality of carbon nanotubes dispersed therein, citing claim 1 of the reference.

The rejection is overcome by the amendments to the claims. Claims 1, 15 and 17 have been amended to recite a limitation on the nanoscale carbon tubes, specifically that the nanoscale carbon tubes are either (ii) amorphous nanoscale carbon tubes; (iii) nanoflake carbon tubes; (iv) iron-carbon composites each composed of (a) a carbon tube selected from the group consisting of nanoflake carbon tubes and nested multi-walled carbon nanotubes, and (b) iron carbide or iron, wherein the iron carbide or iron (b) fills 10 to 90% of the internal space of the carbon tube (a); or (v) a mixture of at least two of (ii) to (iv).

Glatkowski et al. discloses a nanocomposite dielectric comprising a polymer matrix and carbon nanotubes (Claims 1 to 5). However, Glatkowski et al. only discloses **single walled carbon**

nanotubes and multi-walled carbon nanotubes. In other words, Glatkowski et al. does not disclose (ii) amorphous nanoscale carbon tubes, (iii) nanoflake carbon tubes, or (iv) iron-carbon composites, as recited in new Claim 1 of the present application.

The claims, as amended, are therefore not anticipated by Glatkowski.

Claims 3 and 9 are rejected under 35 U.S.C. §103(a) as being unpatentable over Glatkowski et al. (US 2003/0008123 A1) in view of Matsui et al. (WO 2000/40509). Notes: US Pat. 6,960,334 B1 is being relied upon as English equivalence of WO 2000/40509. (Office action paragraph no. 6)

Reconsideration of the rejection is respectfully requested.

The Examiner states that Glatkowski fails to disclose the particular limitations recited in claims 3 or 9 for the carbon nanotubes. The Examiner cites Matsui (column 3, lines 35-40) for teaching a method of manufacturing amorphous nanoscale carbon tubes having the structural limitations in claim 3. The Examiner states that the amorphous CNTs are said to be durable and to possess excellent mechanical, electronic and chemical properties, citing column 2, lines 17-39. The Examiner combines the references by stating that:

> "it would have been obvious to a person having ordinary skill in the art at the time the invention was made to have employed the method taught by Matsui to prepare the CNTs and used them in the nanocomposite taught by Glatkowski so as to lower the overall cost, improve the durability of the final products, and attain better control of the structure and properties of the CNTs, which, in turn, enables greater control on the properties of the nanocomposite dielectric made with such CNTs."

In traversing the rejection, Applicant argues that there is no motivation to combine the references as suggested by the Examiner. The main motivations cited by the Examiner for using Matsui's CNTs in Glatkowski's nanocomposites are: 1) lowered cost; 2) durability of the final product; and 3) "better control of the structure and properties of the CNTs."

First of all, Applicant notes that the Examiner's reference to "control of structure" and "durability" refers to Matsui at column 2, lines 22-25. However, these lines of Matsui specifically refer to the use of carbon nanotubes **for absorbing hydrogen gas** (see column 2, lines 10-16). This does not at all suggest a combination with Glatkowski, in which the nanotubes will be placed in a composite, whose purpose is as a dielectric. Moreover, nanotubes in a composite could not possibly absorb hydrogen gas.

Moreover, regarding point (1), the Examiner has **not** actually demonstrated that Matsui's amorphous nano-scale carbon tubes are cheaper than the conventional gram-quantity nanotubes referred to in paragraph [0059] of Glatkowski. In addition, it is not clear to what extent the price of the nanotubes affects the final cost of Glatkowski's nanocomposite. There is no basis for this motivation to combine the references.

Regarding point (2), Glatkowski does discuss the mechanical strength of nanotubes at paragraph [0060]. However, Glatkowski never indicates that this is a significant consideration in Glatkowski's nanocomposite. Glatkowski clearly uses carbon nanotubes for their dielectric effect on the nanocomposite, and does not discuss their effects on the mechanical properties of the resulting

composite. There is no suggestion in the references that using Matsui's carbon tubes in Glatkowski's polymer would have any effect on the mechanical strength of the nanocomposite.

Regarding point (3), again, the Examiner is referring to a teaching of Matsui regarding use in absorbing hydrogen gas. The disclosure regarding absorption of hydrogen does not provide a basis for concluding that Matsui's nanotubes will perform any better in Glatkowski's nanocomposites than the nanotubes used in Glatkowski.

Applicant argues generally that there is no motivation in either reference for the proposed modification of the references. As noted above, Glatkowski et al. is totally silent about (ii) amorphous nanoscale carbon tubes, (iii) nanoflake carbon tubes, and (iv) iron-carbon composites. Glatkowski et al. states that a low dielectric loss is preferable (page 12, lines 16 to 19).

Matsui et al. discloses an amorphous carbon nanotube as a material with good gas occlusion power (see Abstract, etc.).

However, Matsui et al. does not provide any disclosure or suggestion that the amorphous carbon nanotube is mixed in a resin. In fact, it is clear that Matsui's invention would not work for its intended purpose if the nanotubes were in a resin.

In addition, there is no suggestion in Matsui et al. for any effect on dielectric loss resulting from amorphous carbon nanotube admixed in a resin. Accordingly, there is no motivation in Matsui to modify Glatkowski et al. based on the disclosure in Glatkowski regarding low dielectric loss.

Further, Glatkowski et al. and Matsui et al. contain no disclosures that disprove the conventional theory that $\tan\delta$ increases when an electric conductive material such as a nanoscale

carbon tube is added. The present invention overturns the conventional theory by mixing a small amount of specific nanoscale carbon tubes in a resin. This is clearly an unexpected result of the present invention.

Claims 3 and 9 are not obvious over Glatkowski et al. and Matsui et al., taken separately or in combination.

Claim 6 is rejected under 35 U.S.C. §103(a) as being unpatentable over Glatkowski et al. (US 2003/0008123 A1). (Office action paragraph no. 10)

Reconsideration of the rejection is respectfully requested in view of the amendments to the claims.

The Examiner states that it is well known in the art that thermoplastic resins, such as polycarbonate, are often employed in a wide range of applications, and that "a curable resin (such as urethanes, epoxies, polyimides) is usually incorporated into the thermoplastic resin to improve" certain properties. The Examiner states that, "equipped with that knowledge and in light of the suggestions made by Glatkowski," it therefore would have been obvious to have employed a composite resin in the nanocomposite dielectric of Glatkowski.

As noted above, base claim 1 has been amended to limit the nanoscale carbon tubes to the recited (ii) amorphous nanoscale carbon tubes, (iii) nanoflake carbon tubes, or (iv) iron-carbon composites, or (v) mixtures of these. Glatkowski et al. only discloses **single walled carbon nanotubes and multi-walled carbon nanotubes.**

There is no suggestion in Glatkowski for nanoscale carbon tubes meeting as recited in (ii), (iii), (iv) or (v) of amended claim 1. Moreover, Glatkowski mentions amorphous carbon **byproduct** in nanotube synthesis (paragraph [0087]), clearly implying that any form of amorphous carbon is not generally desired in Glatkowski's invention. There can be no suggestion in Glatkowski for amorphous carbon nanotubes.

Claim 6, as amended, is therefore not obvious over Glatkowski.

Claims 10 and 11 are rejected under 35 U.S.C. §103(a) as being unpatentable over Glatkowski et al. (US 2003/0008123 A1) in view of Nishino et al. (US 2003/0175462 A1). (Office action paragraph no. 13)

The Examiner cites Nishino for disclosing an iron-carbon composite meeting the limitations of the iron-carbon composite in claim 10, and the nanoflake carbon tube of claim 11. The Examiner cites Nishino as disclosing that the composite can be synthesized in large quantities, possesses excellent durability, and that when added to a resin, increases electrical conductivity and mechanical strength (citing [0104], [0163] and [0166] to [0168]). The Examiner states:

> "In light of such benefits, it would have been obvious .... to have modified the nanocomposite dielectric taught by Glatkowski by combining the iron-filled CNTs and nanoflake carbon tubes taught by Nishino with the resins taught by Glatkowski to prepare, at low cost, [] large quantities of durable nanocomposite materials whose properties are easier to control."

Reconsideration of the rejection is respectfully requested.

Nishino et al. states that electrical conductivity is increased and molded resin articles are strengthened by mixing iron-carbon composites into a resin (page 40, lines 8 to 16). However, Nishino et al. does not teach or even suggest that the addition of a small amount of iron-carbon composites into a resin can keep tanδ low. Rather, Nishino et al. teaches that electroconductivity is increased, and therefore tanδ would be expected to **increase**, as discussed above.

Consequently, there is no motivation to combine Glatkowski et al. and Nishino et al. for the purpose of keeping tanδ low. Even if they were combined, it would not have been predictable that tanδ can be kept low by mixing a small amount of specific nanoscale carbon tubes into a specific resin. That is, the effect of the present invention is unexpected over the references.

As described above, Glatkowski et al. and Nishino et al. contain no disclosures that disprove the conventional theory that tanδ increases when an electric conductive material such as a nanoscale carbon tube is added. The present invention overturns the conventional theory by mixing a small amount of specific nanoscale carbon tubes in a resin. This is an unexpected result of the present invention.

Claims 10 and 11 are therefore not obvious over Glatkowski et al. and Nishino et al., taken separately or in combination.

If, for any reason, it is felt that this application is not now in condition for allowance, the Examiner is requested to contact the applicants' undersigned agent at the telephone number indicated below to arrange for an interview to expedite the disposition of this case.

In the event that this paper is not timely filed, the applicants respectfully petition for an appropriate extension of time. Please charge any fees for such an extension of time and any other fees which may be due with respect to this paper, to Deposit Account No. 01-2340.

Respectfully submitted,

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Enclosure: Information Disclosure Statement

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